Attachment 7 – Technical Justification of Projects

Project A: FID – Southwest Groundwater Banking Project

Project Benefits

A detailed feasibility study for the project has been prepared and is attached as **Attachment 3b**. The project will provide the following benefits:

Banked Water/Dry Year Supply. As part of the MOU between JID and FID, the project proposes to utilize existing JID owned wells within the project vicinity to pump stored or banked groundwater for delivery to the McMullin Grade Canal to be used by JID growers. In exchange, JID will make water supply available to FID that can be diverted into FID's system upstream. The feasibility report (**Attachment 3b**) includes an estimation of the groundwater pumping to be an average annual amount of 5,080AF/yr.

Groundwater Recharge. A description and monthly simulation of the available surface water supplies that can be used for groundwater recharge/banking at the project shows that an average of 5,500 AF/year could be recharged by the project. 4,200AF/year at the proposed basin site, and the canal conveyance improvements will allow an additional 1,300AF/yr to be conveyed downstream to James Irrigation District's (JID) existing recharge basins. The simulation is provided in project feasibility study (**Attachment 3b**). JID and FID have entered into an MOU for the project (**Attachment 3a**), and have an existing agreement for the routing of water to James ID (included in **Attachment 3h**). The simulation is based on an assumed recharge rate of 0.5 feet/day. According to the Project Feasibility Study this rate, or an even higher rate, could be maintained at the basin with proper maintenance. Over the 50-year life of the basin recharge would be nearly 250,000 AF. In very wet years, with long periods of floodwater, recharge could be as high as 11,000 AF in one year. Total recharge may be even higher if Kings River entitlement water and San Joaquin River water are also recharged. The recharged water will help to raise groundwater levels, lower groundwater pumping costs, and provide a more reliable dry-year water supply. At minimum, the project proposes to leave behind an average annual amount of 10% or approximately 420AF/yr as a net benefit to the aquifer.

Regulation reservoir. The project could also be used as a temporary regulation reservoir. The reservoir could temporarily store 270 AF of water then divert down McMullin Grade Canal to JID. Water could potentially be regulated multiple times each year.

Sustaining the Fisheries Management Program

This project will help sustain the fisheries management program on the Kings River that is discussed Section 9.1 of the IRWMP while not losing their portion of the committed flows. In addition, FID has committed to being responsible for increased flows to establish the fishery

along the river. The fisheries program commits water to be diverted along portions of the Kings River. This project will allow FID to divert water down the river for the fishery to FID's downstream-most diversion point, and then ultimately route and store the water at the project's recharge locations. FID will then be able to pump groundwater for delivery to JID and exchange or sell the water exchanged using FID and JID supplies in Pine Flat Reservoir. Further, partners like JID could then deliver the exchanged water to FID or a possible water purchaser. FID has constructed similar projects to be able to sustain the fishery flows from the dam to the Fresno Weir along the Kings River, but additional banking capacity is still needed to maintain the 90-140cfs fish flow requirements during dry years.

Floodwater. The project will have the capacity to divert floodwater, creating additional options for the routing of Kings River flood water and local stormwater that is routed into FID's system upstream as part of an agreement to route urban and eastside stream through the urban area. In very wet years, such as 1968-1969, 1979-1980 and 1982-1983, flood water was available for over six months. Floodwater diversions will reduce water levels and peak flows on the Kings River during flood periods, and thereby potentially reduce flood damage. The water will be diverted on the east end of the San Joaquin Valley, and the flood reduction benefits will be realized along a significant reach of the Kings River. These flood flows ultimately reach the San Joaquin River and Delta, so some flood damage reduction will also be seen in those areas. The basin will provide additional 270 AF of surface storage. By providing additional floodwater routing capacity, the project has potential to help reduce flood-related damage to sensitive habitat in the Kings River and local streams. From the water supply analysis included in the Appendix B of the feasibility study (**Attachment 3b**), there is evidence that the project would have allowed for the diversion of approximately 306,000 AF of Kings River and local stream flood water over the past 55 years.

Habitat Creation. The project site will be converted from agricultural land to a 60-acre recharge basin that is periodically flooded. This will provide the following benefits to local wildlife:

- Creation of waterfowl, upland, wetland and aquatic habitat
- Resting, roosting, nesting, drinking, and foraging habitat for waterfowl, shorebirds, resident and migratory birds and a variety of other wildlife
- Waterfowl habitat for bird species on the Pacific flyway
- Water supply for terrestrial wildlife
- Reduction in fugitive dust and pesticide applications from changing the land use from agriculture to recharge basins

The project will also include the following features that will improve wildlife habitat:

- Flat Levee Slopes. Interior levee slopes will be 5H:1V, which will promote the growth of native wetland and upland vegetation to provide wildlife habitat.
- Varying Water Depths. Water depths in the basin will frequently vary, providing a variety of habitat environments for different species, including foraging areas for waterfowl, shorebirds, and other wildlife.

- Interior Levees. The interior levee for the settling channel will provide semi-isolated habitat and safer conditions from predation.

These features will significantly improve habitat for local wildlife, which has been highly disturbed for many years due to agricultural activity.

Water Quality Improvement. This project should have a positive impact on local groundwater quality by mixing high quality surface water with lower quality groundwater. Groundwater quality within the area of the project and within James ID has higher salts, as discussed in the project feasibility report (**Attachment 3b**), and within the IRWMP (**Attachment 1e**).

Increased Conveyance Capacity. The project will include increase the capacity of reaches of Lower Dry Creek Canal to 100 and 200 cfs. These reaches of the canal are currently limited both to the basin site, and from the basin site. The capacity from the basin to the McMullin Grade Canal is less than 50cfs, and the increase will provide capacity to route additional water to downstream demands. This increase will also provide additional conveyance capacity if other surface water sources are available to divert to James ID through FID's Lower Dry Creek Canal.

Energy Conservation. Energy will be saved by raising groundwater levels and reducing pumping lifts. If it is assumed that the recharged water spreads out over ten square miles then water levels will rise several feet each year. It is assumed that this water is available on average for two years before it is pumped out and used. Using these criteria energy savings will be about 37,800 KWH which has a value of about $5,000. This also equates to a reduction in greenhouse gasses of 27 metric tons/year. Energy savings calculations are included as **Attachment 7a**.

Project Physical Benefits

Recent and Historical Conditions

Groundwater levels in Fresno ID and more particularly in the project vicinity are declining. The Kings Basin IRWMP, the RCWD Groundwater Recharge Study (**Attachment 3g**) and Figure 4-11 of the 2007 Integrated Groundwater and Surface Water Model (IGSM, available at www.kingsbasinwater.org) identify the project area of the Kings Basin IRWM that has the most significant overdraft in the region. The depth to groundwater in wells in this area has dropped significantly over the last 10 years.

Without Project Conditions

Without the project none of the benefits would be realized. Surface water supplies would flow out of the Kings Basin and be lost to local water users. The water proposed for recharging, Kings River water, currently flows past James Weir into the San Joaquin River, and is truly lost to the Kings Basin.

Methods Used to Estimate Benefits

The methods used to estimate benefits are described in detail in the project Feasibility Study (**Attachment 3b**). The primary benefit of recharge potential and extraction operation were based on a monthly available supply simulation, the results of which are included at the end of **Attachment 3b**. The primary benefit of groundwater recharge was based on a long-term simulation of available source water supplies, capacity improvements of Lower Dry Creek, use of existing JID wells, basin infiltration rates, and basin storage capacity.

Uncertainty of Benefits

The certainty of the benefits is relatively high since they were determined through a detailed feasibility study in 2012-2013, and FID has recently successfully completed a similar banking facility (Jameson Banking Facility Expansion) within a few of this project. Groundwater recharge is widely considered a beneficial project in overdrafted groundwater basins.

Potential Adverse Physical Effects

No potential adverse effects are anticipated from the project. Recharge basins sometimes cause groundwater mounding and high groundwater levels on adjacent lands. This is a low concern for this project since the basin is depressed and below the surrounding ground surface, and the sandy soils should quickly absorb water delivered to the site. Short-term construction impacts will occur such as noise and dust, but these will be mitigated and minimized as appropriate.

Annual Physical Benefits

The annual physical benefits are summarized in **Table 7-1**, which is similar to Table 9 in the Proposal Solicitation Package. The bases for the values were provided in the 'Project Benefits' section in the beginning of Attachment 7.

Table 7-1 DWR Table 9 Annual Project Physical Benefits				
Year	**Benefit**	**Without Project**	**With Project**	**Change Resulting from Project**
2012-2061	Dry Year Water Supply	0	5,080 AF/year	5,080 AF/year
2012-2061	Groundwater Recharge	0	420 AF/year	420 AF/year
2012-2061	Floodwater Diversion	0	5,500 AF/year	5,500 AF/year
2012-2061	Energy Conservation	0	37,800 kw-hrs/year ($5,000)	37,800 kw-hrs/year ($5,000)
2012-2061	Waterfowl Habitat	0	60 acres	60 acres

The only benefit that cannot be readily quantified and monetized is water quality improvement. The change in chemical constituents will be tracked over time, but such changes cannot be predicted with accuracy due to the complexity of the local stratigraphy, spatial distribution of water quality, and seasonal changes in groundwater flow. As a result water quality benefits were described qualitatively.

Technical Justification

The project has many favorable characteristics for a groundwater banking project including:

1. Suitable Soils for Recharge. The project is adjacent to an existing basin that has observed long term infiltration rates of greater than 0.5 feet per day. The project was identified in the Raisin City Water District (RCWD) Groundwater Recharge Feasibility Study as being in an area of medium to high recharge potential (Figure 2.10 of **Attachment 3g**).
2. Lower Dry Creek Canal. The project is located adjacent to FID's Lower Dry Creek Canal that can convey water from multiple sources to the basin site, and to McMullin Grade Canal that serves James ID.
3. James ID Wells available. James ID has a well-field near the project that can pump the banked or stored groundwater.
4. Multi-agency collaboration. The project is truly a regional project, utilizing existing facilities from two agencies, FID and JID and encouraging joint water supply management between the two agencies.
5. Proven Track Record. FID currently operates 4 different groundwater banking sites, and numerous groundwater recharge basins. JID operates several recharge facilities and its well field located near the proposed basin.
6. Available Surface Water Supply. FID receives urban stormwater from the eastern portions of FID that are diverted into FID's canals for routing through the urban areas.

7. Existing Flood Rights and Easements. The project area is near FID's Flood Rights Easement Area that was developed in the early 1900s as a location for the disposal of excess floodwater in FID's system.
8. Area not served by surface water. The project will recharge water in an area of that does not receive surface water (see Figure 3-3). This area relies totally on groundwater and experiences a higher rate of overdraft than neighboring areas. The groundwater recharge will directly benefit this area and provide more equitable benefits throughout the District.
9. Groundwater Recharge Study. The area was identified as a potential site for groundwater recharge (Figure 2.10 and others in **Attachment 3g**). This same study also performed a model evaluation/simulation assuming low to medium recharge rates at the basin site.
10. Local and regional support. The project has widespread support from local and regional agencies including neighboring landowners, neighboring districts, nearby cities, and the Kings River Conservation District.

Project B: Laguna Irrigation District Recharge Basin 11

Project Benefits

The project will provide the following benefits:

Groundwater Recharge. A simulation of historical Kings River floodwater shows that an average of 2,650 AF/year could be recharged in the basin. The simulation is provided in Appendix C of the project feasibility study (**Attachment 3i**). The simulation is based on an assumed recharge rate of 1.5 feet/day. According to the Project Feasibility Study this rate, or an even higher rate, could be maintained at the basin with proper maintenance. Over the 50-year life of the basin recharge would be 132,500 AF. In very wet years, with long periods of floodwater, recharge could be as high as 11,000 AF in one year. Total recharge may be even higher if Kings River entitlement water and San Joaquin River water are also recharged. The recharged water will help to raise groundwater levels, lower groundwater pumping costs, and provide a more reliable dry-year water supply.

Regulation reservoir. The project could also be used as a temporary regulation reservoir. The reservoir could temporarily store 144 AF of water, and deliver it to Murphy Slough for delivery to irrigators. Water could potentially be regulated multiple times each year.

Floodwater. The project will have the capacity to divert up to 70 cfs of floodwater. Average annual floodwater diversions are estimated to be 2,650 AF. In very wet years, such as 1968-1969, 1979-1980 and 1982-1983, flood water was available for over six months. With six months of floodwater, diversions could be as high as 11,000 AF/year. Floodwater diversions will reduce water levels and peak flows on the Kings River during flood periods, and thereby potentially reduce flood damage. The water will be diverted on the east end of the San Joaquin Valley, and the flood reduction benefits will be realized along a significant reach of the Kings River. These flood flows ultimately reach the San Joaquin River and Delta, so some flood damage reduction will also be seen in those areas.

Habitat Creation. The project site will be converted from agricultural land to a 50-acre recharge basin that is periodically flooded. This will provide the following benefits to local wildlife:

- Creation of waterfowl, upland, wetland and aquatic habitat
- Resting, roosting, nesting, drinking, and foraging habitat for waterfowl, shorebirds, resident and migratory birds and a variety of other wildlife
- Waterfowl habitat for bird species on the Pacific flyway
- Water supply for terrestrial wildlife
- Reduction in fugitive dust and pesticide applications from changing the land use from agriculture to recharge basins

The project will also include the following features that will improve wildlife habitat:

- Flat Levee Slopes. Interior levee slopes will be 5H:1V, which will promote the growth of native wetland and upland vegetation to provide wildlife habitat.
- Varying Water Depths. Water depths in the basin will frequently vary, providing a variety of habitat environments for different species, including foraging areas for waterfowl, shorebirds, and other wildlife.
- Interior Levees. The interior levee for the settling channel will provide semi-isolated habitat and safer conditions from predation.

These features will significantly improve habitat for local wildlife, which has been highly disturbed for many years due to agricultural activity.

Water Quality Improvement. The Recharge Basin 11 project should have a positive impact on local groundwater quality by mixing high quality surface water with lower quality groundwater that exceeds MCL thresholds for some drinking water standards. **Table 7-2** provides a comparison of surface and groundwater quality for some local constituents of concern. Following is a discussion on the source of the data.

Table 7-2 - Summary of Surface and Groundwater Quality in Project Vicinity

Water Quality Parameter	Surface Water		Groundwater	
	Lemoore Weir[1]	Manning Avenue[1]	Range of Concentrations	Number of Wells/Well Clusters
Electrical Conductivity (umhos/cm)	42 (20 to 108)	59 (19 to 164)	200-347	2
Total Dissolved Solids (mg/L)	33 (10 to 63)	41 (11 to 110)	140-200	2
Arsenic (ug/L)[2]	0.6 (0.2 to 1.0)	0.8 (0.3 to 1.4)	41-70	2
Nitrate as NO3 (mg/L)[3]	0.6 (0.2 to 1.3)	0.7 (0.2 to 2.3)	ND to 57.7	4

Notes:
[1] Average value shown first with range of values in brackets. Data from 2006 to 2011.
[2] Drinking water MCL is 10 ug/L and is exceeded in all groundwater samples
[3] Drinking water MCL is 45 mg/L and is exceeded in some groundwater samples

Surface Water Quality. Kings River flood waters will be the primary water source for the Recharge Basin 11 project. The Kings River Conservation District, on behalf of the Kings River Sub-Watershed of the Southern San Joaquin Valley Water Quality Coalition, has been collecting surface water quality data at various locations on the Kings River as part of the Central Valley Regional Water Quality Board's Irrigated Lands Regulatory Program (ILRP) since 2006. Kings River surface water quality from 2006 – 2011 is summarized in the *2012 Laguna Irrigation District Agricultural Water Management Plan* for three monitoring locations along the Kings River. The two closest locations are at Lemoore Weir, downstream from Laton, and at Manning

Avenue in Reedley, upstream from the Liberty Canal diversion point. Water quality from these locations is fairly indicative of the water that will be diverted into Recharge Basin 11.

Based on the values in **Table 7-2**, the Kings River water has good water quality for municipal and agricultural purposes. A broad range of pesticides and herbicides were also tested as part of the ILRP. According to the Laguna Irrigation District's 2012 Agricultural Water Management Plan, for the most part, none of the listed herbicides or pesticides has been detected in reportable/actionable quantities. As these sampling locations are part of a long term regulatory program, Laguna ID can continue to use this information to ensure that water delivered to the project is of high quality.

Groundwater Quality. The general nature of local groundwater quality was obtained from the State Water Resources Control Board – Groundwater Ambient Monitoring & Assessment (GAMA) Program, GeoTracker Website and other publically available information. This overview of groundwater quality is focused on the main constituents of concern in the area. **Table 7-2** includes maximum reported values from 6 wells/well clusters in about a 2.5 mile radius over the last 10 years.

While **Table 7-2**, above, is not an in-depth listing of groundwater constituents in the area, it does provide a baseline dataset to compare to the basic chemical nature of the surface water supply. The groundwater quality also exceeds the drinking water MCL for arsenic in all samples and nitrate in some of the samples. It is clear that Kings River water has much higher quality and should, in time, have a positive impact on the local groundwater quality.

Disadvantaged Communities. The project will have secondary benefits to disadvantaged Communities including the Camden Mobile Home Park and Community of Riverdale. The recharged water may eventually flow to these communities and help to improve their water quality and raise groundwater levels. Riverdale Public Utilities District recognized this potential benefit in their Letter of Support (see **Attachment 7b**).

Increased Conveyance Capacity. The project will include increasing the capacity of Liberty Canal (from 60 cfs to 130 cfs) along a 3.5 mile reach. This will allow delivery to the recharge basin, while meeting full irrigation demands. This increased conveyance capacity will provide other benefits, especially if infrastructure is ever built to deliver surface water to the northern portion of Laguna ID that does not currently receive surface water.

Energy Conservation. Energy will be saved by raising groundwater levels and reducing pumping lifts. If it is assumed that the recharged water spreads out over ten square miles then water levels will rise 5 feet each year. It is assumed that this water is available on average for two years before it is pumped out and used. Using these criteria energy savings will be about 179,000 kwh, which has a value of about $23,000. This also equates to a reduction in greenhouse gasses of 126 metric tons/year. Energy savings calculations are included as **Attachment 7a**.

Project Physical Benefits

Recent and Historical Conditions

Groundwater levels in Laguna Irrigation District and the neighboring Liberty Water District are declining. Data on LID groundwater levels are provided in the project Feasibility Study (page 13 of **Attachment 3i**) and shows a decline of 40 feet from 2000 to 2010. Data from the Liberty Water District, located immediately north of LID, is found in **Attachment 7c**. This data shows a steady decline of 25 to 30 feet in wells over the past ten years. Liberty Water District also mentions the local groundwater level decline in their letter of support (see **Attachment 7b**). The groundwater levels in LID and Liberty Water District are declining at consistent and rapid paces, and therefore create a strong motive for the project.

The importance and feasibility of groundwater recharge is highlighted in several parts of the Laguna ID 2012 Agricultural Water Management Plan:

> "*Due to the unpredictable nature of Laguna Irrigation District's surface water supply, it is necessary to point out that conjunctive use is a very important part of District operations*." (pg 5)
>
> "*Due to the proximity to the Kings River and permeable soils within the District, it is possible to replenish subsurface storage in wet years after drought cycles*." (pg 5)
>
> "*The District could not survive without conjunctive use as its surface water supply is generally not sufficient to meet the water needs of its landowners*." (pg 33)

Without Project Conditions

Without the project none of the benefits would be realized. Surface water supplies would flow out of the Kings Basin and be lost to local water users. The water proposed for recharging, Kings River water, currently flows past James Weir into the San Joaquin River, and is truly lost to the Kings Basin (see Appendix C of **Attachment 3i**).

Relation of Projects

No other projects are proposed that are related to the Recharge Basin 11 Project.

Methods Used to Estimate Benefits

The methods used to estimate benefits are described in detail in the project Feasibility Study (**Attachment 3i**). The primary benefit of groundwater recharge was based on a long-term simulation of Kings River flood flows and considered the capacity of Liberty Canal, capacity of the new turnout, basin infiltration capacity, and basin storage capacity. Liberty Canal Company has granted permission for LID to deliver water to the recharge basin through their expanded canal (see Letter of Support in **Attachment 7b**).

New Facilities, Policies and Actions Required

The following facilities must be constructed for the project: Liberty Canal Expansion, recharge basin, inlet and outlet pipes, and monitoring facilities. The 30% design includes all of these features. The Liberty Canal Company must allow LID permission to convey water in the Liberty Canal to deliver to the site. The canal is being expanded so the recharge deliveries do not interfere with irrigation deliveries, and Liberty Canal Company has sated their intention to allow recharge deliveries in their Letter of Support (**Attachment 7b**). LID must purchase the property for the project to be realized. The landowner has signed an Option Agreement, giving LID the first opportunity to purchase the property for the value stated on a recent land appraisal (**Attachment 3l**).

Uncertainty of Benefits

The certainty of the benefits is relatively high since they were determined through a detailed feasibility study in 2012-2013 and using information from an extensive subsurface investigations program in 2007. Groundwater recharge is widely considered a beneficial project in overdrafted groundwater basins.

Potential Adverse Physical Effects

No potential adverse effects are anticipated from the project. Recharge basins sometimes cause groundwater mounding and high groundwater levels on adjacent lands. This is a low concern for this project since the basin is depressed and below the surrounding ground surface, and the sandy soils should quickly absorb water delivered to the site. In addition, there is a local groundwater depression with groundwater levels at least 100 feet below ground surface. Short-term construction impacts will occur such as noise and dust, but these will be mitigated and minimized as appropriate.

Annual Physical Benefits

The annual physical benefits are summarized in **Table 7-3**, which is similar to Table 9 in the Proposal Solicitation Package. The bases for the values were provided in the 'Project Benefits' section in the beginning of Attachment 7.

Table 7-3 DWR Table 9 Annual Project Physical Benefits

Year	Benefit	Without Project	With Project	Change Resulting from Project
2012-2061	Groundwater Recharge	0	2,650 AF/year	2,650 AF/year
2012-2061	Floodwater Diversion	0	2,650 AF/year	2,650 AF/year
2012-2061	Energy Conservation	0	179,000 kw-hrs/year ($23,000)	179,000 kw-hrs/year ($23,000)
2012-2061	Waterfowl Habitat	0	50 acres	50 acres

The only benefit that cannot be readily quantified and monetized is water quality improvement. The change in chemical constituents will be tracked over time, but such changes cannot be predicted with accuracy due to the complexity of the local stratigraphy, spatial distribution of water quality, and seasonal changes in groundwater flow. As a result water quality benefits were described qualitatively.

Technical Justification

The project has many favorable characteristics for a groundwater recharge project including:

11. Favorable soils. The soils have a high sand content. Some clay and silt layers were found, but they do not appear to be laterally continuous and should not be the primary control of infiltration (see page 8-10 in **Attachment 3i**).
12. Better land use. The property is marginal farmland due to its sandy soils. The land is not cropped every year since it has a high water demand due to high infiltration rates. Some of the farmland is designated 'Unique Farmland', which is defined by the California Department of Conservation as "*Farmland of lesser quality soils*". A recent land appraisal for the property (see **Attachment 3l**) says the land has marginal soils and there are moderate to severe limitations on the crop types that can be grown. The current landowner recognizes these limitations which are his primary motive for wanting to sell the property. A recharge basin is clearly a better use for the land.
13. Liberty Canal. The project is located adjacent to Liberty Canal which can deliver water directly to the site.
14. Murphy Slough. The project is located adjacent to Murphy Slough. Murphy Slough has an invert below the basin level and can be used for overflow spills, or to collect water that is temporarily stored in the basin for delivery to irrigators.
15. Topographic depression. The site is located in an excavated depression that allows water to be delivered by gravity, and will reduce the height of levees needed to develop the project. Groundwater mounding in adjacent areas is a small concern since the water will be percolated below the surrounding natural ground surface.
16. Area not served by surface water. The project will recharge water in an area of Laguna ID that does not receive surface water (see Figure 4.2 in **Attachment 3i**). This area relies totally on groundwater and experiences a higher rate of overdraft than neighboring areas. The groundwater recharge will directly benefit this area and provide more equitable benefits throughout the District.
17. Groundwater Recharge Study. In a 2007 study the site was identified as the best of sixteen potential recharge sites in the area, and was the only sited rated as having 'Excellent' potential for groundwater recharge (See Appendix A in **Attachment 3i**).
18. Local and regional support. The project has widespread support from local and regional agencies including neighboring landowners, neighboring districts, nearby cities, the Kings River Conservation District, and all of the agencies in the North Fork Group. Public outreach efforts include presentations to several agencies and are documented on page 26 of the Project Feasibility Study (**Attachment 3i**). Nine agencies and groups of agencies have written letters of support for the project including: The North Fork Group,

Murphy Slough Association, Riverdale Irrigation District, Liberty Mill Race Company, Burrel Ditch Company, Reed Ditch Company, Liberty Canal Company, Liberty Water District and Riverdale Public Utilities District. These letters are included as **Attachment 7b**. In their letters, Riverdale Irrigation District, Liberty Mill Race Co., Burrel Ditch Company, and Reed Ditch Company have offered to contribute $500 to $1,000 each to the project. This illustrates the strong local support for the project and evidence that other agencies expect to benefit from the recharge basin.

19. Multi-agency collaboration. The project was identified through a collaborative multi-agency effort when the North Fork Group performed a regional groundwater recharge study in 2007.

The justification for the project, and documentation for the benefits claimed, are presented in the project feasibility study, which was completed in January 2013 and is included as **Attachment 3i**.

Project C: Bakman Water Supply Reliability and Conservation Project

Project Physical Benefits

The installation of water meters and wellhead treatment will provide a number of benefits, not only to Bakman, but also to the Kings Basin as a whole, including:

- Water Conservation (Reduced Water Consumption)
- Compliance with State Legislation
- Reduce Pumping Costs
- Increased Water Supply
- Improved Water Quality

Reduce Water Consumption

Quantifying the amount of water saved when a community installs meters and implements a volumetric rate has been extensively studied and discussed. One such study and several local case studies and their respective consumption reduction estimates are shown in the Table 7-4.

Table 7-4: Consumption Reduction Estimates

Source	Description	Consumption Reduction Estimate
Alliance for Water Efficiency	http://allianceforwaterefficiency.org/metering.aspx	15-30%
City of Fresno, Water Division	Initial stages of City-wide metering project. Per capita usage reduced from 301 to 239 gallons per day from 2008 to 2012	21%
City of Clovis	Comparison of metered community in Clovis (249 gpd, Clovis 2010 UWMP) to unmetered community in adjacent Fresno (313 gpd, 2010 Fresno UWMP)	20%
City of Kerman	City of Kerman water records from 2008 to 2010 after meters were installed in part of City (249 gpcpd to 184 gpcpd).	26%

Bakman is anticipating a 20% reduction of their entire deliveries to be achieved with this project, or approximately 869 acre-feet per year. While the project is installing meters on approximately 2/3 of the system, the remaining 1/3 will require additional retrofit to integrate them into the AMR system (as discussed in Attachment 3) and the entire system will be converted to a volumetric rate once the meters are fully installed. The Kings groundwater subbasin is critically overdrafted and water conservation is an important part of restoring and

maintaining the groundwater aquifer. Reduced usage that comes from the meter installation and volumetric rates will help sustain the aquifer.

Compliance with State Legislation

One purpose of the water metering project is to comply with State of California AB2572 requirements to meter the water delivered to all water users and SBx7-7 requirements to reduce water consumption by 20% by 2020 with an interim target of 10% reduction by 2015.

Reduce Pumping Costs

The project will benefit Bakman by reducing the variable costs to pump and deliver groundwater to its customers.

As discussed above, this project anticipates a 20% water conservation (869 AF/yr that can be attributed to the meters being installed with this project), which equates to a proportional reduction in water deliveries. Bakman has an operational cost of $232/AF for pumping, treatment (in some areas), conveyance, labor, energy, etc. This variable cost is documented in Attachment 8.

The groundwater levels in the Kings Basin are declining annually, therefore the cost of pumping will increase proportionally to this decline. This decline is happening near Bakman's service area at an average rate of 1.4 feet per year as shown on the hydrograph for a City of Fresno well near Bakman's northwest boundary at Olive and Chestnut Avenues (Well 13S21E31E001MX – see **Attachment 7e**. This creates a strong motive for a project that conserves groundwater.

Utilizing only the benefit of reduced groundwater deliveries is considered a very conservative estimate of the physical benefits associated with the project. It is important to note that Bakman does not have a surface water supply and is entirely dependent on groundwater to meet the demands. It could be argued that securing a treated surface water source should be included in the avoided costs of the benefit analysis, particularly when considering that groundwater pumping in an overdrafted aquifer with contamination plume concerns cannot continue to increase. Similar avoided costs were included in previous water meter grant applications for proponents that already have access to a surface water supply. Although not used in the benefit analysis, it is important to note that Bakman does not have a surface water supply. The City of Fresno has a surface water treatment facility, but it does not serve the Bakman area. If Bakman could contract with the City of Fresno for treated water from the City's Surface Water Treatment Plant, the cost would be considerably more significant than the alternative of pumping groundwater utilized in this application. As noted in the 2012 City of Fresno Performance Measure summary, the average cost for the City of Fresno to produce 1 acre-foot of safe drinking water from their Northeast Surface Water Treatment Facility was

approximately $450. This is the minimum cost per acre-foot additional supply from surface water sources could cost Bakman.

Increase Water Supply & Improve Water Quality

Bakman relies solely on groundwater in an overdrafted aquifer, and therefore the protection of supply reliability is critical, as is the protection of groundwater quality. In the immediate area surrounding Wells 8 and 8A, there are known contaminant plumes nearby within the groundwater aquifer. Several wells have concentrations of DBCP, TCE and nitrates. These wells are either designated as inactive, treated, blended, or are below the maximum contaminant level (MCL) and left untreated (see Regional Groundwater Contamination Map – **Attachment 7f**).

In conjunction with these plumes, Remedial Action Plans (RAPs) have been put into place or are in planning and design stages. The Old Hammer Field Remedial Action Plan is the nearest to Bakman and specifically Well 8 and 8A (one of the RAP's alternatives cites Bakman's Well 14 for extraction purposes) and is currently in operation. One method of remediating groundwater is to pump and treat to an acceptable level for farming or other non-potable uses and discharge the minimally treated water into the canal system. While this does accomplish remediation, it also pumps the already overdrafted aquifer 'to waste'. By installing treatment that allows potable use of the contaminated groundwater, Bakman will aid in the remediation efforts and use the water pumped for beneficial uses, thereby increasing system redundancy and improving the water quality. Additionally, this method allows more water to remain in the aquifer for future generations, thereby increasing the groundwater supply.

To achieve similar benefits, the likely alternative would be for Bakman to drill a new well with associated treatment and transmission mains. This new well would potentially be farther south and include transmission mains to the Wells 8/8A distribution area to provide system redundancy and to avoid impacting the RAPs near the northern boundary; it is anticipated at least ¼ mile transmission connection would be required. Installation of a new well would be difficult for several reasons. Within the immediate area surrounding Bakman's northern borders, two aquifer remediation plans/agreements are actively being implemented. Both of these plans have placed serious restrictions on installation of new wells in the immediate area and, if new well construction is allowed, the capacity of the well is severely limited. Further discussion of the costs of the 'avoided project' can be found in Attachment 8.

Annual Physical Benefits

As discussed previously, the physical benefits of this project are Reduced Water Consumption and Reduced Water Delivery and Pumping Costs. The annual physical benefits are summarized in **Table 7-5**, which is similar to Table 9 in the Proposal Solicitation Package. The bases for the values were provided in the 'Project Benefits' section in the beginning of Attachment 7.

Table 7-5 – Bakman Annual Project Physical Benefits				
Year	**Benefit**	**Without Project**	**With Project**	**Change Resulting from Project**
2013-2043	Reduced Water Consumption	0	869 AF/year	869 AF/year
2013-2043	Reduced Groundwater Pumping and Delivery Costs	$0	$185,100	$185,100 ($213/AF/year)

Technical Justification

The benefits detailed above are justified in the following manner (identified per each benefit):

- Compliance with State Legislation - President of Bakman Water Company, Tim Bakman ((559) 255-0324) and the Water Company's consulting engineering, Lon Martin, PE (559-449-2700). This benefit is not quantifiable; however, failure to meet requirements of the legislation discussed would result in inability for the Water Company to compete for future funding opportunities and failure to meet the goals set forth in their UWMP.
- Reduced Pumping Costs and Water Supply – As discussed in above, Bakman is using a 20% water supply savings and a directly proportional 20% savings in pumping and operational costs. Additionally, the California Public Utilities Commission confirms the water conservation benefit and supports the project (See **Attachment 7g).**
- Previously Approved Nitrate Blending Plan (**Attachment 3m**), and letter from CDPH (**Attachment 7d**) identifying typical and successful use of GAC in the area for DBCP treatment and testing requirements required to meet drinking water standards.

Project D: San Joaquin Water Supply Reliability and Conservation Project

The installation of meters will be instrumental for the City of San Joaquin in conserving water. The installation of the meters will also enable the City to accurately track actual water consumption by customers and identify potential leaks.

The City of San Joaquin currently delivers an average of 737 acre-feet of groundwater annually to meet its customers' demands. The ground water is extracted from the Kings Sub-basin, which is part of the greater San Joaquin Valley Groundwater Basin. When meters are installed on all residential customers and they are billed on a volumetric system, the City anticipates a savings of approximately 147 acre-feet of water each year.

Project Physical Benefits

The installation of water meters and well rehabilitation will provide the following benefits:

- Water Conservation (Reduced Water Consumption)
- Compliance with State Legislation
- Reduce Pumping and Operational Costs
- Increased Water Supply

Water Conservation (Reduce Water Consumption)

As discussed above in Table 7-4, San Joaquin is anticipating a water savings from the meter installation of 20%. The water savings is also dependent upon implementation of a volumetric rate.

San Joaquin is anticipating a 20% reduction to be achieved with this project (147 acre-feet per year). This savings is crucial to the sustainable water supply of the Kings Basin. San Joaquin is located in an area that has historically been stricken by drought and overdraft of Kings Basin aquifer.

Table 7-6: San Joaquin Water Demands

Year	Volume (AF)
2005	681
2006	678
2007	742
2008	795
2009	789
Average	**737**

Additionally, the installation of residential meters will improve the City's water management through measurement automation. The City will be able to use this additional data and information for a variety of purposes such as planning, customer service, conservation, rate development, and design for infrastructure construction. Meters can be used to identify water

loss within the distribution system by making total usage data available, which can be compared to flow meters at wellheads.

Compliance with State Legislation

One purpose of the water metering project is to comply with State of California AB2572 requirements to meter the water delivered to all water users and SBx7-7 requirements to reduce water consumption by 20% by 2020 with an interim target of 10% reduction by 2015.

Reduce Water Delivery Costs

The project will benefit the City of San Joaquin by reducing the variable costs to pump and deliver groundwater to its customers.

As discussed above, this project anticipates a 20% water conservation (147 AF/yr that can be attributed to the meters being installed with this project), which equates to a proportional reduction in water deliveries. The City has an operational cost of $294/AF for pumping, treatment, conveyance, labor, energy, etc derived from values in their Rate Study (**see Attachment 7h**). This variable cost is documented in Attachment 8.

The groundwater levels in the Kings Basin are declining and are expected to continue to decline despite conservation efforts due to expected population growth in the region. The decline is happening at an average rate of 1.7 feet per year, as shown on the hydrograph for Well 15S16E28A003M (see **Attachment 7i**), which is within the City's service area. This creates a strong motive for conserving groundwater.

Energy Savings

The San Joaquin residential water meter installation project will save an estimated 20% of the energy consumed in pumping. The current annual electrical usage to pump water from the City's wells is 312,000 KWH. The energy savings is due to the estimated 20% lower demand placed on the pumps, and is estimated at 62,400 KWH annually.

Increase Water Supply Reliability

The City currently has only two wells which together cannot meet peak demands or required fire flows. If one well is lost or out for maintenance than water shortages could be severe.

The City's water system is currently served by only two active wells: Well No. 3 and Well No. 5. Well No. 3 is the lead well, which typically is operated to meet the average and maximum day demands and Well No. 5 typically is operated to meet the peak demands. Well No. 4 was removed from service in September 2010 under direction from the California Department of Public Health (CDPH) due to sporadic detection of total coliform, E. Coli and pseudomonas bacteria in the well.

Well No. 3 produces 1,200 gpm and Well No. 5 has a capacity of 1,100 gpm. Therefore, the current maximum production rate is 2,300 gpm, which is less than the peak demand of 3,500 gpm. Additionally, Well No. 3, the oldest well, was constructed in 1968, and is nearing the end of its useful life. In addition to the source capacity deficiency, the City's water system does not have any storage facilities.

The proposed well rehabilitation will provide additional groundwater pumping capability to allow the City to meet peak fire flow demands if needed. The improvements will clean and correct the contaminated well and provide suitable water quality. This will improve the reliability of the water supply as well as enhance operational flexibility and reduce system constraints. The California Department of Public Health (CDPH) also confirms the acceptability of reintroducing this well into the system to provide redundancy and increased fire flow (see **Attachment 7j – CDPH Letter**).

To achieve a similar benefit, the likely alternative would be for the City to drill a new well to provide fire flow and water supply reliability. Further discussion of the costs associated with this 'avoided project' can be found in Attachment 8.

Annual Physical Benefits

As discussed previously, the physical benefits of this project are Reduced Water Consumption, Reduced Pumping Costs and Increased Water Supply. The annual physical benefits are summarized in **Table 7-7**, which is similar to Table 9 in the Proposal Solicitation Package. The basis for the values were provided in the 'Project Benefits' section in the beginning of this attachment.

Table 7-7 – City of San Joaquin Annual Project Physical Benefits

Year	Benefit	Without Project	With Project	Change Resulting from Project
2013-2042	Reduced Water Consumption	0	147 AF/year	147 AF/year
2013-2042	Reduced Pumping Costs	0	$43,218	$43,218 ($294/AF/year)

Technical Justification

The benefits detailed above are justified in the following manner (identified per each benefit):

- Compliance with State Legislation – City of San Joaquin staff. This benefit is not quantifiable; however, failure to meet requirements of the legislation discussed would result in inability for the City to compete for future funding opportunities.

- Reduced Water Consumption and Pumping Costs – As discussed in above, the City is using a 20% water supply savings and a directly proportional 20% savings in pumping costs. The City will justify this benefit by comparing pre- and post-project consumption data to verify water savings upon completion of the project. This analysis will utilize data collected one-year prior and one year post-project to determine the actual water savings.
- Increased Water Supply – the well rehabilitation project will increase the available water supply for the City and will be justified by tracking the amount of production made available post-project.

Project E: City of Kerman Residential Water Meter Project – Phase III

Project Physical Benefits

Water Conservation (Reduce Water Consumption)

Through the use of water meters and charging for this commodity based on a volumetric rate (see **Attachment 3v**); service customers will be more aware of the value of this resource and use it more wisely. The City of Kerman has previously installed meters in a portion of the City and their data after installing the meters and implementing a volumetric rate shows a consumption reduction of 26% (see Table 7-4). For this project, the City is conservatively anticipating a reduction of 20%.

The City's average water consumption is 249 gpcd and the project will install meters on 693 connections. The average household in the City has approximately 4.2 people which equates to water consumption savings for 2,910 people. An expected 20% reduction would realize a savings of 156 AF/yr (2793*249*365*.2/325851) = 156 acre-feet/year.

Compliance with State Legislation

One purpose of the water metering project is to comply with State of California AB2572 requirements to meter the water delivered to all water users and SBx7-7 requirements to reduce water consumption by 20% by 2020 with an interim target of 10% reduction by 2015.

Reduce Water Delivery Costs

The project will benefit Kerman by reducing the variable costs to pump and deliver groundwater to its customers.

As discussed above, this project anticipates a 20% water conservation (162 AF/yr that can be attributed to the meters being installed with this project), which equates to a proportional reduction in water deliveries. Kerman has an operational cost of $249/AF for pumping, treatment, conveyance, labor, energy, etc. This variable cost is documented in Attachment 8.

Resource Restoration and Environmental Stewardship

A significant though difficult to quantify benefit of the project is the restoration of the groundwater aquifer. The elimination of groundwater pump and expansion of conjunctive use allows the groundwater aquifer to become a sustainable resource in the City's water portfolio. It cannot be over stated that the transition from a state of groundwater overdraft to one that has a balance between replenishment and extraction makes this a resource in perpetuity. As so many communities struggle with an over reliance on groundwater without appropriately

addressing replenishment, this project strengthens the City's ability to support economic growth, improve water resource management and environmental stewardship.

Drought Resilience

As the groundwater aquifer recovers from being in a condition of overdraft, it also becomes an increasingly important resource during periods of sustained drought. The State of California has and will continue to experience periods of multiple year drought. Currently the City of Kerman derives 100% of its water from the groundwater. During these periods, it is imperative to the City that there is suitable water available to meet the City's demand. During drought periods even Cities with surface water treatment facilities and surface water resources may have to extract more ground water than during normal rain fall years. The restoration of the groundwater system affords the Cities the opportunity to extract more groundwater when experiencing these dry conditions.

Annual Physical Benefits

As discussed previously, the physical benefits of this project are Reduced Water Consumption and Reduced Pumping Costs. The annual physical benefits are summarized in **Table 7-8**, which is similar to Table 9 in the Proposal Solicitation Package. The basis for the values were provided in the 'Project Benefits' section in the beginning of this attachment.

Table 7-8 – City of Kerman Annual Project Physical Benefits

Year	Benefit	Without Project	With Project	Change Resulting from Project
2014-2043	Reduced Water Consumption	0	162 AF/year	162 AF/year
2014-2043	Reduced Pumping Costs	0	$40,338/year	$40,338/year (varies)

Technical Justification

The benefits detailed above are justified in the following manner (identified per each benefit):

- Compliance with State Legislation – City of Kerman staff. This benefit is not quantifiable; however, failure to meet requirements of the legislation discussed would result in inability for the City to compete for future funding opportunities.

- Reduced Water Consumption and Pumping Costs – As discussed in above, the City is using a 20% water supply savings and a directly proportional 20% savings in pumping and operational costs.